114. *Akiyosiphyllum, a New Type of Permian Rugose Corals from Japan**.

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(Comm. by H. YABE, M.I.A., Nov. 12, 1942.)

The Akiyosi[1] and Ohuku[2] plateaux, Yamaguti prefecture, are built of a thick series of limestone, Lower Carboniferous to Permian in age. Near Ôta[3], close to the southern border of the Akiyosi plateau, lies a zone of alternating sandstone and shale, intercalating a limestone bed, less than 10 m thick. This limestone is fossiliferous and contains corals, bryozoas, bivalves, and other remains. The coral described in this paper was collected by Mr. M. Kawano from the limestone exposed at Ôkubo, near Ôta; its age, judging from the occurrence of *Hexagonella* in association with the coral, is evidently Permian. The coral itself also has a geologically young aspect.

Akiyosiphyllum, gen. nov.

Genotype: *Akiyosiphyllum stylophorum*, sp. nov.

Corallum compound, fasciculate? Corallites cylindrical, slender, radially symmetrical. Major septa uniformly long, all extending to broad columella, somewhat swollen near outer wall and fused together to form inner wall, which is often incomplete; beyond inner wall more or less reduced in thickness, sometimes even tending to disappear; usually with a very short minor septum in alternation. Columella broad, round in cross section, solid owing to rich development of streom; in cross section, coarsely areolate and traversed by a spindle-shaped median lamella or primordial columella with short lateral projections, only where streom is not yet fully developed (probably at or near calicular floor). Tabulae represented by numerous, crowded vesicules arranged in conical layers; dissepiments vesicular, arranged in several layers.

Remarks: On cursory inspection, this coral is liable to be confounded with *Waagenophyllum*, which it closely resembles in the mode of growth, size, and other megascopic features of the corallites. An outstanding characteristic of the former, however, is its broad compact columella, by means of which it is easily distinguished not only from *Waagenophyllum*, but also from other similar rugose corals, such as *Siphonodendron* and *Cionodendron*.

The present coral is intimately related to *Siphonodendron*[5], having

* One of the researches done in 1942 with the aid of a grant from the Imperial Academy.

1) 秋吉. 2) 於福. 3) 太田. 4) 大久保.

5) *Siphonodendron* McCoy, 1849, with the genosyntype *Lithodendron pauciradialis* McCoy, *L. fasciculatum* Phillips and *L. cimale* Phillips, was proposed for fasciculate *Lithostrotion*. The first species was recently redescribed in detail by D. Hill (A Monograph on the Carboniferous Rugose Corals of Scotland, Pt. III. Pal. Soc. London, 1914, p. 169, pl. IX, figs. 1, 2; text-fig. C).

the same fundamental structure. The latter possesses a thin platy columella, which is prolonged to the cardinal and counter septa, while the same structure still persists in the middle of the broad columella of the former as primordial columella or median lamella; the broad compact columella built up of streoplasmic deposit evidently being a character that was acquired later in the course of phyletic evolution.

In many typical species of *Siphonodendron*, the tabulae are represented by conical plates in series, which not seldom ramify, showing a tendency to vesiculate—a process greatly advanced in the present coral, the area of tabulae being occupied by numerous vesicules arranged in conical layers. Although the size of the vesicules vary considerably, in the average they are similar to those of the dissepiments.

Cionodendron Benson and Smith[1], with *C. columen* Benson and Smith, from the Lower Carboniferous of New South Wales as the genotype, represents another type of corals related to *Siphonodenaron*, from which it is believed to have been derived. Although the two genera agree in growth-habit, size, form, and general structure of the corallites; *Cionodendron* is characterized by having more numerous septa, and by the columella which in later growth-stages becomes broad and dense by enclosing the inner ends of the major septa, and occassionally also the lamellae which corresponds, in position, to the minor septa. "In the microscopical structure, the columella is very similar to that of *Amygdalophyllum*" which "is built up of slightly curved conical layers superimposed one upon the other", and shows "in transverse section a short medial plate and the inner ends of major septa" within it[2].

The distinction of the present coral from *Cionodendron* lies in (1) the highly progressed vesiculation of the tabulate area, (2) the less numerous and thick septa, and (3) the densely calcified solid columella of the former. *Cionodendron* apparently occupies an intermediate position between *Siphonodendron* and the present fossil.

The present coral also strongly recalls *Geyerophyllum*[3], especially in the growth-stages that proceed the appearance of its coarsely areolate outermost zone. In *Geyerophyllum* Heritsch, with *G. carnicum* Heritsch (the genotype) and *G. broilii* Heritsch from the uppermost Carboniferous of the Carnic Alps, the corallum or corallites are pentareal, that is, in cross section, built up of (a) the columella, (b) the intermediate zone traversed by the major septa alone, (c) the dissepimental zone with dissepiments, at least 3-layered in the counter- and 1-layered in the cardinal quadrants, (d) the vesiculated zone with considerably reduced or almost disappearing septa, and (e) the outermost zone which is coarsely areolate; zones c and d are separated by an inner wall and zones d and e by another inner wall.

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1) W. N. Benson and S. Smith: Rugose Corals from the Burindi Series. Quart. Jour. Geol. Soc. London, vol. LXXIX, p. 165, 1923.

2) Quoted from Benson and Smith's paper, l. c.

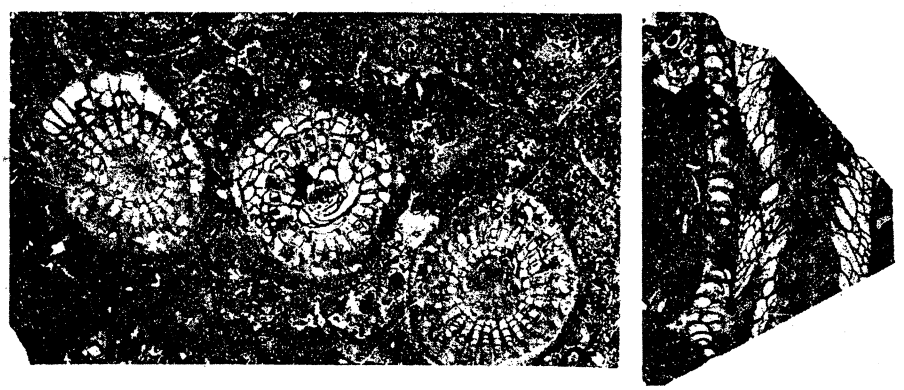
3) F. Heritsch: Korallen der Moskauer-, Gschel- und Schwagerinen-Stufe der Karnischen Alpen. Palaeontographic, vol. LXXXIII, A, 1936, p. 132.

In *Geyerophyllum*, its zones b and c, according to Heritsch, seem to be well differentiated, which, however, is never the case with our coral; it is not very probable that, in longitudinal sections, the dissepiments are differently disposed in the two forms. In the absence of longitudinal sections of *Geyerophyllum*, it is not possible, at present to say anything definite regarding their relationship.

Akiyosiphyllum stylophorum, sp. nov.

Figs. 1, 2.

Corallum compound, fasciculate. Corallites cylindrical, slender, round in cross-section, less than 8 mm broad. Columella broad, 7 mm in diameter, being about one-third of that of corallites, solid, showing no minor structure other than the obscure trace of median lamella or primordial columella, which is elongated toward two opposite (presumably cardinal and counter) septa and fusiform in cross-section; primordial columella and the coarsely vesiculated structure around it distinctly discernible only at the distal part of columella where streom is not yet developed. Major septa less than 30, usually 24–28 in number, alternating with a very short minor septum; stout, rapidly attenuating distally, and extending to solid columella or, where this is not yet fully developed, to vesiculated zone around its median lamella; dilated proximally, and joined laterally to each other, forming there an inner wall near the outer wall. Inner wall almost as thick as the outer: often incomplete. Tabulae abundant, vesiculated, or to express it differently,



1 2

Figs. 1, 2. *Akiyosiphyllum stylophorum*, sp. nov. ×4.

replaced by numerous vesicules arranged on conical layers; in cross-section of corallites, represented by several, more or less regularly concentrical lines; vesicules variable in size, similar in their average dimensions to those of dissepimental zone. Dissepiments vesicular, vesicules arranged in 2–3 layers.

Locality: Ôkubo, Ôta-mati, Mine-gun, Yamaguti prefecture. The holotype stored in the Institute of Geology and Palaeontology, Tôhoku Imperial University; Reg. No. 65033.

Geological age: Permian.

Remarks: Many years ago, A. Ozawa described *Lonsdaleia gerthi* Ozawa[1] from the same district (Siraiwa, Ômine-mura, Mine-gun); later Heritsch thought that it probably belongs to his *Geyerophyllum*.

Ozawa figured several specimens of this species in both cross- and longitudinal sections. His Fig. 9, Pl. XII, represents a cylindrical or rather cylindroconical corallum or corallite, 10 mm broad and more than 45 mm long, with some 30 major septa radially arranged in alternation with much shorter minor ones, a relatively thick columella, and interseptal loculae occupied by distant, somewhat concave tabulae disposed horizontally in the inner half of the interior of the corallite and by numerous vesicular dissepiments in several more or less concentrical, funnel shaped layers in its outer half. Ozawa's form, though somewhat similar to ours differs distinctly from it by the zone of distant horizontal tabulae around the columella.

Other figures of *Lonsdaleia gerthi* Ozawa (Figs. 10–12, Plate XII, and Fig. 10, Plate XIII) show the corallites in cross section; they are all double walled; Ozawa's description quoted below agrees well with the features shown by the figures.

"Central column strong and bisymmetrical in cross-section, composed of merely septal tabellae. The arrangement of tabellae resembles that of *Carruthersella* Garwood or that of *Carcinophyllum wichmanni* Gerth. Columella of full grown specimen well defined and separated from major septa excepting counter septum, which is continuous with the central plate. Septa of two orders, major and minor. Major septa strong and generally reach the epitheca, but when the outer area of dissepiments is developed, the base of the septa thickened and fused together to form the pseudowall. Minor septa either confined to this pseudowall or represented by mere septal ridge." "Outer zone when present, formed of narrow zone of very coarse dissepiments."

While Ozawa's view of the specific identity of the corals of the second type with the other coral shown in Fig. 9 needs confirmation with the aid of longitudinal sections of the former which he perhaps could not prepare form his material, the former type closely approaches ours in the size and form of corallites, construction of columella, number, size, and arrangement of major and minor septa, and in the possession of an inner wall; although the unknown mode of the arrangement of septa in longitudinal section in one type prevents any definite conclusion regarding its generic and specific relationship with the other type.

The specific identity of the two types has been confirmed, "*Lonsdaleia*" *gerthi* Ozawa should be regarded as being generically distinct from the present form; in the other case, the specific name should be retained only for the first type, seeing that it is better illustrated by its author in cross- and longitudinal sections than the other; there is then the possibility of Ozawa's second type being identical with ours.

All the specimens of "*Lonsdaleia*" *gerthi* are from a limestone of

1) Y. Ozawa: Palaeontological and Stratigraphical Studies on the Permo-Carboniferous Limestone of Nagato, Pt. II, Palaeontology. Jour. Coll. Sci. Imp. Univ. Tokyo, vol. XLV, art. 6, 1925, p. 73.

Sibukuro; Ômine-mura, together with *Neoschwagerina douvillei* Ozawa, *Yabeina shiraiwensis* Ozawa, and *Sumatrina annae* Volz.

It should further be added that a corallite closely resembling, in cross-section, the present form, was found in a limestone from Nukata, Simo-Yakuno-mura, Amata-gun, Kyoto prefecture (Reg. No. 65034); this limestone is probably also Permian in age, since the same limestone exposed at Takauti contains *Leptodus* (*Lyttonia*)[1].

1) K. Mashiko: Discovery of *Lyttonia* in a limestone exposed at Takauti, Naka-Yakuno-mura, Amata-gun, Kyoto Prefecture. Jap. Jour. Geol. Geogr., vol. XI, Nos. 3-4, 1934, p. 181.